

26
ANNUAL REPORT OF THE DIRECTOR

OF THE

SOUTH DAKOTA
AGRICULTURAL
EXPERIMENT
STATION

FOR THE YEAR ENDING JUNE 30th, 1912

AS REQUIRED BY ACT OF CONGRESS, AUGUST 30th, 1890

ANNUAL REPORT OF THE DIRECTOR OF THE EXPERIMENT STATION

President Robert L. Slagle,
College

Dear Sir:—

I have the honor to make the following report of the South Dakota Agricultural Experiment Station for the fiscal year ending June 30th, 1912:

THE STAFF

With few exceptions the personnel of the Station staff was the same as for last year. Mr. A. N. Hume was selected to fill the vacancy as chief of the Agronomy Department, and Mr. J. C. Hutton was selected for assistant chief in Agronomy. Mr. C. M. Woodworth, assistant in Crops; Mr. Wm. White and Mr. W. R. Tolstrup, assistants in Dairying, resigned to accept better paying positions.

ORGANIZATION

This Station is supported by funds received from the federal government. There are seven departments as follows:

Agronomy, Animal Husbandry, Botany, Chemistry, Dairying, Horticulture, Veterinary.

Experiments are conducted along these lines for the benefit of the people in the state. They are made as practical as possible, and from the demand for the results, we believe the Station is highly appreciated by the farmers of South Dakota.

The United States Department of Agriculture co-operated with this Station during the year in growing

grains, sugar beets, and with the sub-station at Highmore along agronomy lines.

At the beginning of the fiscal year the Hatch and Adams funds were apportioned to the different departments, which includes part of the salary of each employee, as follows:

HATCH FUND

Agronomy	\$ 1600 00
Animal Husbandry	1805 00
Botany	2000 00
Chemistry	1330 00
Dairy Husbandry	980 00
Executive (including printing)	5170 00
Horticulture	1315 00
Veterinary	800 00
Total	15000 00

ADAMS FUND

Agronomy	3400 00
Chemistry	1700 00
Dairy Husbandry	3810 00
Horticulture	5100 00
Veterinary	990 00
Total	15000 00
Grand Total	\$30000 00

PUBLICATIONS

Seven bulletins were printed during the year as follows:

Bulletin 132. Effects of Alkali Water on Dairy Products.

Bulletin 133. Alfalfa as a Field Crop in South Dakota.

Bulletin 134. More Winter Dairying in South Dakota.

Bulletin 135. Trials with Millets and Sorghums for Grain and Hay in South Dakota.

Bulletin 136. Fattening Pigs.

Bulletin 137. Corn Silage and Roots for Steers.

Bulletin 138. Hog Cholera.

SYNOPSIS OF CONTENTS

Bulletin No. 132—EFFECTS OF ALKALI WATER ON DAIRY PRODUCTS, by the Department of Dairy Husbandry.

Many inquiries were received from localities in which alkali is most prevalent, relative to the effects of its use in connection with the varied phases of the dairy industry. Experience of certain dairy farmers indicated that the milk from cows drinking alkali water did not coagulate normally for cheese making purposes when rennet was added. Others refused to let the cows drink it, fearing that the cows and the milk might be injured, while other dairy farmers thought that washing the butter in alkali water would affect the butter. At the National Creamery Buttermakers' Convention held in St. Paul in 1907, a creamery operator from an adjoining state asked the question, "Is it injurious to wash butter in alkali water?" In this large audience composed of practical and scientific dairy and creamery men, no one was able to give a definite answer.

It has been amply demonstrated that stale and putrid water will impart undesirable flavor and odors to milk when drunk by the cow. Some alkali wells contain water which is not only rich in soluble minerals, but which is also brackish and almost putrid in taste and smell. When such water is drunk by the cow, her milk will not be clean of flavor and smell. This undesirable quality of milk can not be laid to the alkali or minerals in the water, but rather to the decayed organic matter so common in alkali water. In the semi-arid regions, especially in the newly settled localities, shallow wells are common, and frequently the water from such wells contains too much organic matter.

The conclusions indicate that cows receiving alkali water did not produce milk containing a greater per cent nor a greater amount of total minerals than did cows receiving soft water, although each cow receiving alkali water consumed about 0.5 of a pound more of soluble minerals per day than did those fed on soft water.

The milk ash from cows receiving the alkali water may vary in its percentage composition without affecting the total per cent of ash. In these experiments the sulphate and potassium were the two chief ash constituents that show an increase by feeding alkali water. Considering the large amount of sulphates consumed this increase is however small, and so far as the investigators were able to ascertain, this variation in per cent of ash constituents was not sufficiently great to affect in any way the various normal properties of the milk and its products, butter and cheese.

The coagulability of milk with rennet was not affected by feeding alkali water to the cows. On the other hand the variation in the coagulability of the milk appears to bear a relation to the per cent of calcium in the milk and individuality of the cow. The milk low in calcium required the most rennet for curdling and produced the softest coagulum; and this milk was produced by cows well advanced in the gestation period.

Alkali water, free from decayed organic matter and foreign odors, when fed to cows did not taint the milk, even though the water had a distinctly sharp and slightly saline taste. Neither did the butter made from this milk differ in quality from that made of milk produced by cows receiving normal and soft water.

Some of the alkali water examined was foul and stale and gave evidence of containing decayed organic matter. Such water is dangerous to use for dairy cows, for cleaning dairy utensils, and in connection with the manufacture of dairy products.

Butter washed in alkali water and containing a normal percentage of salt, was not found to differ materially

in quality from that washed in normal water and condensed steam.

The unsalted butter washed in alkali water was scored about one point lower in quality than was the butter washed in normal wash-water.

Although the alkali wash-water contained a large number of non-acid producing germs, these were almost entirely supplanted by the still larger number of acid producing germs in the butter shortly after its manufacture.

The cheese made from the milk produced by the cows fed alkali water, was normal, both through the various stages of manufacture and during the curing time. By the senses of taste, smell and sight no qualities were found different from those of cheese made of milk from cows receiving normal water.

From the analysis, the brine soluble protein is low, and the insoluble protein is high, in freshly made cheese from the milk produced by the cows receiving alkali water. These differences however are much diminished after the cheese had been cured one month.

The reports or complaints made by some dairy farmers as to the probable, undesirable effect of alkali water on the flavor and properties of the milk, evidently should be accounted for in other ways than by the alkaline condition or excessive amount of minerals in the water.

Bulletin No. 133.—ALFALFA AS A FIELD CROP IN SOUTH DAKOTA, by the Agronomy Department.

*Interest in alfalfa as a field crop in South Dakota is perennial, like the plant itself. Farmers are constantly asking for facts about the crop in question, and want these facts applied to the conditions of their home farms.

The present bulletin is principally an attempt to summarize the average yields of alfalfa hay from plots that have been harvested for a number of successive years in South Dakota. These actual yields of hay per acre, averaging as many years as possible have much practical and scientific value.

The Agronomy Department has had considerable experience with alfalfa at two points in South Dakota,

namely, at Brookings and at Highmore. Some limited tests have been carried on at other points.

Average yields of alfalfa hay, from several varieties of seed have been produced at Brookings, which have been more profitable than average crops of wheat or corn.

Average yields of alfalfa hay from some strains of seed have been produced at Highmore which were at least as profitable as average crops of wheat or corn. It is also exceedingly important to know that some strains failed to withstand the conditions at Highmore.

Trials of alfalfa by a number of co-operators in several parts of the state yielded some information. Further very carefully conducted, long-time experiments, such as those at Brookings and Highmore, and other points will be necessary to solve alfalfa problems.

"Yellow-flowered" alfalfa apparently possesses great hardiness, which quality is of exceeding importance, especially under our more severe conditions. Seeds of alfalfa that fail to germinate may be improved by some process of "scratching" the hard seed coats, and such treatment is apparently beneficial to all kinds of alfalfa seed. Trials with a seed "Preparator" yielded this information.

Bulletin No. 134.—MORE WINTER DAIRYING IN SOUTH DAKOTA, by the Department of Dairy Husbandry.

At the present time the dairy business in South Dakota is not practiced intensively except by comparatively few farmers. Dairying is carried on largely as a side-line. In this connection the readers should bear in mind that South Dakota is a new state and that it has been and still is in a transitional period. It is passing through the different farming stages through which all other great agricultural states have passed, with this difference, that the duration of the various stages between range farming and the more intensive mixed system of permanent agriculture is much shorter. The rise in value of land, the increase in rural population, the higher price of crops, and the depletion of soil by continuous cropping in South Dakota, have been so rapid that it is somewhat difficult for the

average tiller of the soil to keep pace with necessary farming progress.

The dairy business is practiced on the majority of South Dakota farms. According to the Thirteenth United State Census, seventy-eight per cent of all cows over two years old are classed as dairy cows. The average number of cows per dairy farm is six. During the last decade from 1900 to 1910 the number of dairy cattle increased from 270,634 to 369,764. From the above data it is evident that the dairy business in South Dakota is increasing but not intensively practiced except in few instances.

Although this be the case the aggregate value of the dairy products is great. According to the dairy expert's last annual report the aggregate value of dairy products during 1910 was \$8,185,890.00, ranking the dairy industry as one of the great agricultural resources of the state.

During the last five years the Dairy Husbandry Department has been investigating how the present obstacles to more successful dairying could be overcome, and how the dairy business might be practiced with fewer difficulties and more profit than at present. One answer to these inquiries is, more intelligent winter dairying: the chief advantages may be summarized as follows:

Dairy products are higher in price during the winter.

Winter labor is cheaper and more plentiful.

Cows freshened in the fall produce more milk and butter fat during the milking period.

Calves dropped in the fall are easier to raise.

Bulletin No. 135. TRIALS WITH MILLETS AND SORGHUMS FOR GRAIN AND HAY IN SOUTH DAKOTA, by the Agronomy Department. Under the climatic conditions prevalent in South Dakota, it is often desirable to include in the farming system certain crops that have the quality, or combination of qualities, that may be termed, for lack of better words, "drouth evasion." For this purpose the millets have their chief value. For example, if the cutworms or early frosts, ruin the corn, or hot winds and drouth destroy the wheat, oats or

barley in June, the provident farmer may sow sufficient millet to furnish forage for his stock. This use of the millets is well understood by the public; but that millet may be grown as a grain crop to furnish feed for poultry and to supplement the ration for growing stock and dairy cows, is not so well understood. In the season of 1911, when the feed problem was serious on many farms, a small investment in millet seed coupled with a few hours work in preparing the land might have produced a rank growth of roughage and a fair crop of rich grain.

A considerable amount of experimental work has been done by the Agronomy Department in co-operation with the office of the Grain Investigations of the United States Department of Agriculture, and it is believed that the present knowledge of the millets is sufficiently developed to warrant the presentation of the data obtained, considering not only the seed, but the soil, the preparation of the seed bed and the subsequent handling and utilization of the crop.

The highest average of grain secured at Highmore from any variety of millet in years 1907-10 was 17.6 bushels per acre, from common millet. The next highest average was 16.0 bushels per acre from Black Voronezh, this being also practically the yield from Kursk and Tambov varieties. Kursk varieties of millet in 1910 produced a higher yield of hay, and are, all considered, most promising, the average of the highest yields of Kursk for all seasons being 24.7 bushels of grain per acre. The facts apparently warrant the increased use of Kursk Millet as a grain crop in South Dakota.

It requires a longer time for grain sorguhms to grow to maturity than for millet. The average yield of grain per acre for three strains of Kowliang (grain sorgum) for three years, including two extremely unfavorable seasons was 13.7 bushels per acre. This illustrates their extremely drought resistant quality.

Bulletin No. 136. FATTENING PIGS, by the Animal Husbandry Department. The production of pork is one of the principal industries in the corn belt. The pig will

yield a larger return for the feed consumed than either the sheep or the steer and will make a larger daily gain for his weight than any other animal on the farm.

All animals fatten rapidly when receiving corn as a ration on account of its highly carbonaceous nature. But the question is often asked by farmers who are practicing dairying to a greater or less extent, what is the value of skim milk and buttermilk for the pig when fed in conjunction with corn? Skimmilk and buttermilk are considered in some places as waste products, but when fed in the proper quantity to pigs less grain is required for the production of a pound of gain than when corn is fed alone. Skimmilk and buttermilk are similar in composition, both being proteinaceous and highly digestible. Experiments show that when feeds of this nature are fed in conjunction with grains to pigs, the gains are more rapid and as a rule cheaper than when they receive the corn alone.

The market in this state for fat hogs is as good as one could wish, as part are shipped to eastern points and part to Pacific coast points. The breeds raised are principally those of American origin, the Poland-China, Duroc-Jersey and Chester-White, although there are a few herds of the English breeds such as Berkshire and Yorkshire. All seem to do well and are suited to our conditions. However, the breed is only a small part of the success to be obtained in the economical production of pork, as much more depends on the nature of the feeds and the feeder. The hog requires a variety of feeds with good pasture in summer and warm sheltered quarters where it can get plenty of exercise in winter.

Sweet skimmilk, sour skimmilk and buttermilk are practically equal for pigs when fed in the proportion of from two and one-half to three pounds of milk to one pound of shelled corn. Pigs weighing from 80 to 100 pounds, on a ration of corn and milk in proportion as above stated made an average gain of 1.65 pounds daily during a feeding period of 62 days. The lots receiving milk made an average gain in 62 days of 32 and 42 pounds more, respectively, than

did the lots receiving shelled corn and water. The milk evidently increased the appetite, since the pigs receiving it consumed a larger quantity of grain. In fattening an animal, any feed that will increase the consumption of grain and hasten early maturity, providing the cost of such product is not prohibitive, must be considered a benefit.

Ordinarily, with all ages of swine, a bushel of shelled corn will produce an average of 10 pounds of pork. In this experiment, on an average for the two years of feeding period of 62 days each, a bushel of shelled corn yielded 11.9 pounds of pork. But when an average of 153 pounds of milk was fed with a bushel of shelled corn, an average yield of 17.7 pounds of pork was produced. This was a difference of 5.8 pounds in favor of the milk lots; or in other words, the milk was equal to 5.8 pounds of pork. However, it must not be understood that this quantity of milk fed to a pig without the corn would yield this amount of gain; but when fed in combination, as above stated, similar results are to be expected.

The pig is the most economical producer of all meat-producing animals on the farm, yielding larger returns daily for live weight and feed consumed than either the sheep or the steer and furnishing a market at home for grain and dairy by-products.

Bulletin No. 137. CORN SILAGE AND ROOTS FOR STEERS, by the Animal Husbandry Department.

This bulletin includes the results of two experiments in feeding corn silage to steers. The object of these experiments was to determine the value of silage as a sole ration for wintering steers and also as a roughage, when fed with grain, for fattening operations. It was further desired to determine the value of different root crops when added to the grain ration for fattening steers.

Results show that common millet hay of the fox-tail type was a comparatively poor feed as a sole ration, for wintering steers, as there was practically no gain made during the 90 day feeding period. No bad results were received by feeding steers all the corn silage they would eat without

other grain or roughage. At the end of the experiment they were consuming an average of 70 pounds per head daily. The steers were not as fat as they would have been had they received a full grain ration and evidently much of this gain can be credited to growth. Feeders in the corn belt could well afford to make this cheap gain before fattening for summer market.

Neither corn fodder from the field or fodder silage or a one-half ration of silage and hay proved as valuable for wintering steers as first class corn silage (fodders cut from same field at same time as corn for silage) as it required more pounds of dry matter for a pound of gain than with the silage lot.

In each case when silage or roots were fed with shelled corn and wild hay there was a larger gain than with the lot that did not receive these succulent feeds. For fattening steers, hay with silage proved to be better than hay or silage alone as a roughage.

Results show that the mangel-wurzel beet was the best of the three kinds fed. As a feed it was more palatable than other varieties and less corn was required by this lot for a pound of gain than for any other lot.

Bulletin No. 138. HOG CHOLERA, by the Veterinary Department. Hog cholera is an infectious disease of swine characterized by a high fever and more or less extensive congestion and hemorrhages of the lymphatic glands, the intestines, kidneys, lungs, spleen, heart and liver. Various other names have been applied to this disease, such as pig typhoid, swine fever, pneumo-enteritis, blue disease, etc., but it is most frequently referred to as hog cholera.

The annual loss of pigs from this disease in the United States amounts to thousands of dollars and its ravages are a constant source of discouragement to breeders of pure-bred stock as well as those who make a special business of feeding hogs for the market. It is impossible to determine the extent of the disease in South Dakota; and while in general the disease is confined to the southeastern portion of the state, yet outbreaks have been reported in various

other sections of the state, including the most northern counties.

Potent and virulent hog cholera serum is distributed by this department approximately at cost, which under the present methods of manufacture is estimated at two cents per cubic centimeter. The cost of vaccination is therefore directly dependent upon the weight of the hogs to be treated and by consulting the table of dosage will be found to vary from twenty to thirty cents for a small pig to one dollar and a half for a five-hundred-pound hog. So far as vaccination against hog cholera is concerned therefore it can be readily regarded as a cheap form of insurance policy against this disease, allowing the owner to retain the full number of animals in the herd and to keep them over until fully matured for market.

To intelligently fill requests for serum it becomes necessary to know: The number of hogs in the herd; the approximate weight of the individuals in the herd; whether or not cholera is present in the herd or simply in the immediate locality; and if the disease is present, the number that show any indications of being sick.

The following is a list of daily, weekly and monthly publications received in exchange for the Station bulletins: It will be noted these publications are from all parts of the world and could be used to great advantage by students in the agricultural courses. But on account of the limited space in the general library of the college these exchanges are filed away in an inaccessible place and are of little value to the institution.

EXCHANGE LIST

DOMESTIC PERIODICALS.

- Agricultural Epitomist, Spencer, Ind.
- American Breeder, Kansas City, Mo.
- American Fertilizer, Philadelphia, Pa.
- American Hay, Flour and Feed, New York, N. Y.
- American Hereford Journal, Kansas City, Mo.
- American Miller, Chicago, Ill.

- American Poultry Advocate, Syracuse, N. Y.
 American Swine Herd, Chicago, Ill.
 Better Fruit, Hood River, Ore.
 Carlson's Breeders' Review, Norfolk, Neb.
 Chicago Daily Farmer's and Drover's Journal, Union
 Stock Yards, Chicago, Ill.
 Cincinnati Weekly Inquirer, Cincinnati, Ohio.
 Clay, Robinson & Company's Live Stock Report, Chi-
 cago, Ill.
 College Farmer, Columbia, Mo.
 Corn, Waterloo, Iowa.
 Country Gentleman, Philadelphia, Pa.
 Commercial Fertilizer, Atlanta, Ga.
 Connecticut Farmer, New Haven, Conn.
 Coleman's Rural World, St. Louis, Mo.
 Cotton Seed, Atlanta, Ga.
 Daily Drovers Journal, Stockman, South Omaha, Neb.
 Deseret Farmer, Salt Lake City, Utah.
 Deutsch-Americanische Farmer, Lincoln, Neb.
 Elgin Dairy Report, Elgin, Ill.
 Farm Journal, Philadelphia, Pa.
 Farm and Real Estate Journal, Traer, Iowa.
 Farmer and Breeder, Sioux City, Iowa.
 Farmers' Digest, Columbia, Pa.
 Farm and Stock, St. Joseph, Mo.
 Farm and Fireside, Springfield, Ohio.
 Farm Life, Chicago, Ill.
 Farm Progress, St. Louis, Mo.
 Farm, Stock and Home, Minneapolis, Minn.
 Farmer, The, St. Paul, Minn.
 Farmers Guide, Huntington, Ind.
 Farm World, Augusta, Me.
 Field and Farm, Denver, Colo.
 Flour and Feed, Milwaukee, Wis.
 Fruit Grower, St. Joseph, Mo.
 Garden Magazine, Garden City, N. Y.
 Guernsey Breeder's Journal, Peterboro, N. H.
 Hoard's Dairyman, Fort Atkinson, Wis.

- Gos-Podarz, Omaha, Neb.
Holstein-Friesian World, Ithaca, N. Y.
Hospodarsky Listy, Chicago, Ill.
Indian School Journal, Chilocco, Okla.
Jersey Bulletin and Dairy World, Indianapolis, Ind.
Jewish Farmer, New York, N. Y.
Kimball's Dairy Farmer, Waterloo, Iowa.
Kansas Farmer, Topeka, Kansas.
Lebanon Independent, Lebanon, S. D.
Long Island Agronomist, Medford, L. I.
National Farmer, St. Louis, Mo.
National Farmer, Wenona, Minn.
National Stockman and Farmer, Chicago, Ill.
Northwestern Agruculturist, Minneapolis, Minn.
Northwest Farmstead, Minneapolis, Minn.
Pacific Dairy Review, San Francisco, Cal.
Poultry Topics, Lincoln, Neb.
Practical Dairyman, Patterson, N. J.
Profitable Farming, St. Joseph, Mo.
Progressive Farmer, Phoenix, Ariz.
Progressive Poultry Journal, Mitchell, S. D.
Progressive Farmer and Southern Farm Gazette, Raleigh, North Carolina.
Pure Products, New York, N. Y.
Reliable Poultry Journal, Quincy, Ill.
Republic, St. Louis, Mo.
Rural New Yorker, New York, N. Y.
Sioux Valley News, Canton, S. D.
South Dakota Farmer, Sioux Falls, S. D.
Spokesman Review, Spokane, Wash.
Successful Farming, Des Moines, Iowa.
Successful Poultry Journal, Chicago, Ill.
Wallace's Farmer, Des Moines, Iowa.
Wisconsin Farmer, Madison, Wis.
Weekly Market Grower's Journal, Louisville, Ky.

FOREIGN PERIODICALS.

- Agricultural Gazette, Sidney, N. S. W., Australia.
Agricultural Journal, Pretoria, South Africa.

- Bureau of Science, Manila, P. I.
Boletin da Agriculture, Kingston, Jamaica.
Department of Agriculture, Melbourne, Victoria, Australia.
El Agricultor Mexicano, Jaurez, Chih. Mex.
Estacion Experimental Para cana de Agucia, Lima, Peru.
El Cultivo Del Triog, Buenos Ayres, Argentine Republic.
Farmer's Magazine, Montreal, Can.
Farm and Ranch Review, Calgary, Can.
Farmers Advocate and Home Journal, Winnepeg, Can.
Hokido Agricultural Experiment Station, Sapporo, Japan.
Journal of the Department of Agriculture, Adelaide, Australia.
Las Orges, Culliness, Milan, Italy.
Natal Agricultural Journal and Mining Record, Maritzburg, South Africa.
New Zealand Dairyman, Wellington, New Zealand.
O Criador Pan Lista, Sao Paulo, Brazil.

ANIMAL HUSBANDRY

Seven different experiments with animals have been conducted during the year as follows:

1. To determine the value of the following feeds as a sole ration for wintering steers; corn silage, made of corn when nearly all the ears were in the dent stage; fodder silage, made of dry corn fodder and mixed with water after putting in silo to cause it to pack better, to exclude the air; corn fodder from the field; and millet hay.
2. To determine the comparative value of cotton seed meal, oil meal, and distillery spirits, pound for pound, when fed with a full ration of corn meal for fattening steers.
3. To determine the value of sweet skimmilk, sour skimmilk and buttermilk, when fed with a full ration of shelled corn for fattening pigs.
4. To determine the value of the hog motor as a contrivance to compel the hog to do his own grinding.

5. To determine the relation of feed to period of gestation with **swine**.

6. To determine the value of distillery spirits when fed with a corn and oats ration for fattening lambs.

7. To determine the cost of producing a Short Horn bull calf until one year old.

With the able assistance of Mr. Hans Hanson, who is paid entirely from the federal funds, and Mr. Lawrence McGarry, who is paid from the state funds, these experiments were carried on successfully.

Many requests for information along animal lines were received during the year, and were answered promptly.

BLACKLEG VACCINE DISTRIBUTION.

The United States Department of Agriculture manufactures blackleg vaccine, and because of the large demand for the vaccine from the residents of this and adjoining states a fresh supply is kept on hand and is sent on request. This arrangement saves at least two days, and means much to the cattle growers. From letters received this prompt service is highly appreciated by the cattle men of the Northwest. During the year there were 15,555 doses sent.

The following financial statements prepared by Mr. R. A. Larson, secretary, explain themselves.

I enclose herein and make a part of this report, reports from the various departments that give a more detailed statement of work in each department.

Respectfully submitted,

JAMES W. WILSON,
Director and Animal Husbandman.

Financial Statement, by R. A. Larson, Secretary

**EXPENDITURES BY DEPARTMENTS
HOME STATION**

	Hatch	Adams	Station Local
Agronomy	\$ 2103 73	\$ 3159 29	\$ 1 60
Botany	1813 08		
Chemistry	1336 72	1595 76	
Executive	2560 33		
Horticulture	1563 66	5539 95	627 87
Printing	1329 09		
Veterinary	764 25	983 26	1362 60
Animal Husbandry	2551 13		2232 64
Dairy Husbandry	978 01	3721 74	75 00
	15000 00	15000 00	4299 71

EXPERIMENT STATIONS AND SUB-STATIONS RECEIPTS 1911-1912

	Home Station	Highmore Sub-Sta	Eureka Sub-Sta	Citt'nwood Sub-Sta.	Miscellan- ous	Total
Hatch	15000 00	.....	.....	.....	.....	15000 00
Adams	15000 00	.....	.....	.....	.....	15000 00
State Appropriation .....	.....	.....	.....	.....	.....	15000 00
Land Endowment .....	.....	3000 00	4500 00	6000 00	2000 00	15500 00
Sales of Produce .....	.....	.....	.....	.....	1068 95	1068 95
Balance on Hand	1626 54	32 90	12 00	34 65	.....	1706 09
	4108 87	.....	.....	.....	1303 04	5411 91
	\$35735 41	\$3032 90	\$4512 00	\$6034 65	\$4371 99	\$53686 95

AGRONOMY DEPARTMENT

Director J. W. Wilson,
College.

Dear Sir:

According to your request of a recent date, I beg leave to make the following annual report for the Agronomy Department of this Experiment station.

Since the previous annual report was submitted, under the date of June 26, 1911, parts of two cropping seasons have been covered, both of which have had influence upon the projects conducted by this Department under the Adams and Hatch Funds. The work of the summer of 1911 was conducted under conditions of extreme drought so that in a number of instances, it was difficult to recover suitable seed from experiment plots for continuing the work. In the present season, however, conditions have been exceedingly favorable. Rainfall has hardly been the limiting element at any time, and the crop yields, although not all completely harvested, bid fair to be the maximum.

The two lines of work conducted under the Adams project, as arranged by agreement between this Experiment station and the office of Experiment stations of the Department of Agriculture, Washington, D. C., were conducted as per arrangement.

The first feature of this project is a study of several crop rotations, with the special object in mind of determining the comparative effect of these several rotations, and of plant food applied in connection with them in depleting, or maintaining, or increasing the fertility of the land. The rotations under this project consist of:

1. Corn, wheat, oats, clover,
2. Corn, oats, wheat, clover.
3. Corn, oats, clover.
4. Corn, wheat, legume.
5. Corn, barley, legume.
6. Corn, Durum wheat, legume.
7. Continuous corn.

8. Continuous wheat.
9. Continuous barley.
10. Continuous oats.
11. Continuous Durum wheat.

The effect of these rotations upon soil is being studied according to definite plans as per arrangement with the office of Experiment Stations. Chemical analyses of samples taken by stated method will show the supply of the several plant food elements present in the soil at stated times, and by comparing the amounts, it will be possible to secure information concerning the effect of the several cropping systems.

A second feature of the work conducted under the Adams project consists of an investigation of the morphological characteristics of corn, wheat, oats. The project resolves itself into a study of correlations between characteristics in plants. These studies may involve either morphological or chemical characteristics of corn or small grain.

As suggested above, the crops included in the work of the present year are in excellent condition at this time, although they are not yet harvested and naturally conclusions are not drawn. Under the Hatch Fund, the work of determining which crops and which cropping systems may be most suitable for permanent and profitable agriculture in South Dakota, is being conducted. In addition to this, as a definite project under the Hatch Fund, a study of a live stock system of farming as compared with a grain system of farming is being conducted. The main features of this project as briefly described are as follows:

A live stock system differs from a grain system essentially in the fact that grain is mainly fed to live stock on the farm rather than being sold away from the land, thus the actual plant food elements are taken away from the soil more slowly, but perhaps none the less surely, under a live stock system of farming. Moreover, with live stock systems it is possible to have access to supplies of farm manure. It is through these supplies that plant food is tak-

en from the soil and fed to stock, is again in part returned to the soil, and furthermore, this same use of farm manure may largely assist in maintaining a supply of humus, and thus, indirectly, a good physical condition and an adequate supply of water. A comparative study of live stock with grain system of farming in South Dakota is of fundamental importance to the agricultural interests. The relative costs of conducting the two systems and the relative profit which may be derived therefrom, and the possibilities of each of the two systems for soil maintenance, the economic effect of pursuing either of the two systems—all these are considerations which make such a study of vital interest under the conditions of South Dakota.

During the year, three bulletins have been issued by the Agronomy Department. They are as follows:

Bulletin No. 133. "ALFALFA AS A FIELD CROP IN SOUTH DAKOTA," by Albert N. Hume and Samuel Garver (February, 1912). Bulletin 133 is summarized as follows:

(1) Average yields of alfalfa hay, from several strains of seed have been produced at Brookings, which have been more profitable than the average crops of wheat or corn. Such a fact augurs well for permanent, profitable farming in South Dakota. Page 260.

(2) Average yields of alfalfa hay from some strains of seed have been produced at Highmore, which were at least as profitable as average crops of wheat or corn. Such a fact augurs also well for permanent, profitable farming in South Dakota. It is also exceedingly important to know that some strains failed to withstand the conditions at Highmore. Page 267.

(3) Trials of alfalfa, by a number of co-operators in several parts of the state yielded some information. Further, very carefully conducted, long-time experiments, such as those at Brookings and Highmore, at other points will be necessary to solve alfalfa problems. Page 268.

(4) "Yellow Flowered" alfalfa apparently possesses great hardiness, which quality is of exceeding importance, especially under our more severe conditions. Page 272.

(5) Seeds of alfalfa that fail to germinate, may be improved by some process of "scratching" the hard seed coats, and such treatment is apparently beneficial to all kinds of alfalfa seed. Trials with a seed "preparator" yielded this information. Page 281.

(6) Five species of alfalfa. Page 274.

(7) Some earlier bulletins, relating to alfalfa in South Dakota are as follows:

Bulletin No. 94. ALFALFA AND RED CLOVER. By James W. Wilson and H. G. Skinner.

Bulletin No. 96. FORAGE PLANTS AND CEREALS AT HIGHMORE SUB-STATION, 1904-1905. By W. A. Wheeler, John S. Cole and S. S. Balz.

Bulletin No. 101. FORAGE PLANTS AT HIGHMORE SUB-STATION, 1906. By W. A. Wheeler and S. Balz.

Bulletin No. 120. PROGRESS IN VARIETY TESTS OF ALFALFA. By Clifford Willis and J. V. Bopp.

Bulletin No. 150. UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY. "The Wild Alfalfas and Clovers of Siberia, with a Perspective View of the Alfalfas of the World." By N. E. Hansen.

Bulletin No. 135. "TRIALS WITH MILLETS AND SORGUHMS FOR GRAIN AND HAY IN SOUTH DAKOTA," by A. N. Hume and Manley Champlin, (March, 1912): Bulletin No. 135 is summarized as follows:

(1) The highest average yield of grain secured at Highmore from any variety of millet in the years 1907-1910 was 17.6 bushels per acre. from common millet. Page 315.

(2) The next highest average yield was 16.0 bushels per acre from Black Veronezh, this being also practically the yield from Kursk and Tambov varieties. Page 315.

(3) Kursk varieties of millet in 1910 produced the highest yield of hay, and are, all considered, most promising, the average of the highest yields of Kursk for all seasons being 24.7 bushels of grain per acre. Page 317.

(4) The facts apparently warrant the increased use

of Kursk millet, as a grain crop in South Dakota. Page 318.

(5) It requires a longer time for grain sorghums to grow to maturity than for millet. Page 326.

(6) The average yield of grain per acre for three strains of Kowliang (grain sorghum) for three years, including two extremely unfavorable seasons, was 13.7 bushels per acre. This illustrates their extremely drouth resistant quality. Page 327.

The third bulletin published by the Department was a brief Press Bulletin intended to stimulate the selection and use of better seed grain throughout the state.

Very respectfully,

A. N. HUME, Agronomist.

BOTANICAL DEPARTMENT

James Wilson, Director,

South Dakota Experiment Station.

Dear Sir:

I have the honor to submit the following report of the Department of Botany and Plant Pathology for the fiscal year ending June 30th, 1912.

The work of the department has been in large part a continuation of the investigations of former years, on grain rusts. Considerable progress has been made in my studies of life histories and cytological structures of rusts, one scientific paper being published during the year, and material gathered for a bulletin on grain rusts to be published in the fall. One of the assistants in the department, Mr. Fromme, worked for some months on flax rust; and after his resignation last September to accept an assistantcy in Columbia University, published a paper on the subject.

The department furnished laboratory facilities for several months to Mr. F. J. Pritchard, of the U. S. Department of Agriculture, who published in October last his very important discoveries on wheat rust. Mr. Pritchard

discovered while working here that the rust is sometimes present in the embryo of the seed grain, and comes up with the germinating plant, infecting the basal leaves of the seedling. This work, which we are now continuing, is of the greatest economic importance; and if Pritchard's discoveries are corroborated, this will necessitate a complete revision of our methods of attack for grain rust.

Besides this work on grain rust the department has also been making a special study of potato diseases. The Dry Rot of the potato last year destroyed the crop almost totally in the Black Hills, as well as in several localities west of the Missouri river. The disease has now gained entrance into the eastern half of the state and promises to become a widespread trouble. The work of the department has had mainly in view the finding of adequate means of control.

Besides this work on plant diseases above outlined, the Botany Department has identified many weeds and other plants, including quack grass, Canada thistle, perennial sow thistle and many other noxious weeds; and has given advice concerning the eradication of these weeds. Many samples of seed have been examined for noxious weed seeds.

Several members of the Botanical staff, in particular Mr. Sarvis, have been working in a more or less desultory manner toward a revision of the list of the State Flora, the station bulletin published some years ago on the subject being out of print. This work has recently progressed quite satisfactorily and is nearing completion.

Very respectfully,

EDGAR W. OLIVE,

Botanist and Plant Pathologist.

CHEMISTRY DEPARTMENT

Director James W. Wilson,

Dear Sir:

The work of this Department continues along two lines of sustained investigation. The first is a Hatch project, seeking to improve and develop a strain or strains of sugar beets of true type and of high sugar content suitable for our state conditions. Also to take up lines of experimentation applicable to commercial production, such as growing sugar beet seed, which includes the growing and siloing of Stechlinge. The second line is an Adams project and deals with problems of nutrition intimately connected with live stock growing in the state.

I. HATCH PROJECT.

The work of this fiscal year was commenced in co-operation with the U. S. Department of Agriculture, Bureau of Plant Industry. All the different varieties of mother beets grown the previous year were planted. Likewise all our different varieties of home grown seed were planted. In addition upwards of fifty varieties of the best seed grown by Morrison of Washington in co-operation with the same Bureau. Stechlinge were grown and siloed. Although this work was done in a very poor manner and notwithstanding the unusual severity of the winter good results were secured where anything like adequate protection was furnished.

In the analytical work composite tests were made of the different home grown varieties and upwards of 2500 analyses were made of single beets of the Morrison strains. Notwithstanding the drouth stricken condition of the whole country surprisingly good results were obtained from our home grown varieties, both in weight and in sugar content.

In the matter of seed-bearing we were not so well favored. While we obtained some seed of all varieties of our home grown seed, and these seeds were of a surprising high vitality, considered from a commercial standpoint the

seed crop was nearly a failure as were all other seed crops, especially of our usual small grains.

Owing to this fact the Bureau become dissatisfied with our state conditions owing to this one season's deficit, and so proposed to practically withdraw from the state asking us to confine our labor to planting a few mother beets. It was proposed to take this work up again next year or later.

This arrangement would have practically destroyed all the previous work done and would have resulted practically in a total loss of all the splendid varieties already developed. Moreover should anything happen to the few mothers planted such as destruction by hail or insect pests, our state would not have recovered from the stigma for years to come.

Consequently after full consultation with the President and Director of this station, it was decided that in order to safeguard the state we would discontinue our co-operation with the Bureau and do the work ourselves.

Accordingly the work of sowing seed and planting mothers and stechlinge was begun last spring. Work on spacing and growing stechlinge and in propagating from analyzed mother evergreen beets was duly started. At this writing our plats are in a most satisfactory condition. Our seed all germinated well and our mother beets are all setting seed up to practically 100 per cent. These facts justify the steps taken.

II. ADAMS PROJECT.

The work of determining Digestion Coefficients with horses has been concluded. During the year the effect of feeding a single wide unbalanced ration has been under investigation. The feeding stuff selected was oat straw. It is a common practice for farmers in the Northwest to turn out young and idle stock during the winter to rustle a living on straw stack and in fence corners. It is a well known fact that stock thus treated come out thin, potbelled and staring coated.

This investigation is shared by the Veterinary Department of this station. A large amount of chemical work

has been done on the straw and faeces. Weights and measurements have been made. Muscles have been calipered and blood counts for leucocytes, etc., have been made.

It is too early to indicate what the results will be as the data are not all compiled at the close of the year.

Very respectfully submitted,
JAS. H. SHEPARD, Chemist.

DAIRY DEPARTMENT

Director James Wilson,
Brookings, So. Dak.

Dear Sir:

The dairy husbandry department during the last year has conducted experiments with both Hatch and Adams funds. The Hatch fund available for this department has been very limited. On this account, the writer has been unable to push any of the Hatch projects to completion.

With the use of Hatch money three projects are under way:

First: To determine the cost and practicability of storing ice under farm conditions. During the last three seasons ice has been stored on the top of, and in pits in the ground. Some of the ice thus stored was hauled from the river, while some was frozen by running water into the pit. Some ice has been used daily, each succeeding summer, for cooling the milk and cream from the dairy herd, in much the same manner as it should be used on our dairy farms. Careful records have been kept as to the per cent shrinkage, and other factors governing the cost of ice storage.

During the coming year an equal amount of ice will be stored in an ice house with a view of ascertaining the comparative loss of storage.

Second: To ascertain the efficiency and practicability of the milking machine having collapsible teat cups. This particular type of milking machine has been in constant use in the dairy herd for nearly two years. During this time careful observations and records have been kept

of the effect of this machine on the cows, and its ease and cost of operation, and the sanitary condition of the machine milked milk. The writer had planned to publish a preliminary report on the work of the milking machine at the close of this year, but on account of the resignation of one of the assistants, to accept a more remunerative place, some bacteriological work was not completed. The writer hopes in the near future to secure enough funds to make a comparative study of the various machines operated on the vacuum principle.

From the present results the writer believes that the practicability of the milking machine is near at hand.

Third. To determine the efficiency and practicability of using the coil cream ripening vat, both as a pasteurizer, and cream ripener: First, as to the ability of the coil ripener to heat and cool cream; second, as to its ability to kill bacteria; third, its effects on the size of the fat globules; and fourth, its effect on the chemical composition of the cream.

This experiment will probably be completed during the coming year.

In addition to the above mentioned projects, some Hatch fund was expended for keeping the milk and feed records of the dairy herd. This will eventually be valuable data.

The work with the Adams fund has been strictly limited to one project, viz: "The Effect of Alkali Water on Dairy Products and Dairy Cows." Last year the results of the first part of the subject pertaining to the effect of alkali water on dairy products were published in a bulletin.

During the year just closed, strong alkali water has been shipped in from Midland, a town west of the Missouri river. Two cows have received no other kind of water during the year. Though these cows have been affected, no fatalities have resulted.

For certain periods of time the amount and kind of intake of food by each cow has been carefully determined. The amount and kind of outgo from each cow during the

same period has also been determined. This was done with the special view of finding out how the excess of minerals in the alkali water were disposed of by the cow.

The experiment, consisting of three periods, was carried through during the year. The writer wishes to duplicate it during the coming year to be sure of results.

Respectfully submitted,

C. LARSEN,
Professor of Dairy Husbandry.

HORTICULTURE DEPARTMENT

Director James W. Wilson,
South Dakota Experiment Station.

Dear Sir:

The work of the Department of Horticulture during the past year has been mainly along the same lines outlined in previous reports. Special attention is given to the breeding of hardy orchard and small fruits; some attention is also paid to developing hardy ornamentals, especially roses; and to the introduction of the alfalfas which I brought from Russia and Siberia in 1906 and 1908 as Agricultural Explorer sent by Hon. James Wilson, Secretary of Agriculture. During the winter the work of breeding strawberries, grapes, gooseberries and roses was carried on in the new fruit breeding greenhouse, and much seed was harvested. Good progress was also made in the breeding of hardy apples and pears.

Finished Work in Horticultural Plant-Breeding.

The following nine new varieties were introduced spring 1912, all resulting from the plant-breeding experiments in this department. The cooking tests of our new plums, conducted by a number of experienced housekeepers the past season, all show that the quality of some of these new plums when cooked is superior to that of the average California plum as we receive them here. The hybrids of

native plum and Chinese apricot especially show the strong apricot flavor and rich fragrance, entirely unlike any native plum.

1. **TOKATA PLUM.** Female parent is the large, firm-fleshed fragrant apricot plum of China, (*Prunus Simoni*), popular in the orchards of California; male parent, DeSoto, a well known native plum (*Prunus Americana*) from Southwestern Wisconsin.

2. **KAHINTA PLUM.** Female parent, the Apple Plum, a Japanese variety, originated by Luther Burbank, of California; male parent, the Terry, a native plum (*Prunus Americana*) originated by the late H. A. Terry, of Crescent, Iowa.

3. **OZIYA PLUM.** Female parent, Red June, a large early Japanese plum; male parent, DeSoto, a well known native plum from southwestern Wisconsin. Oziya was our earliest large plum in 1911, remarkable for its large size and very bright red color; flesh light yellow and of excellent quality.

4. **CIKANA PLUM-SAND-CHERRY.** Of same pedigree as my Opata but much later in season. This pedigree is: Female parent, the Dakota Sand Cherry (*Prunus Besseyi*); male parent, the Gold plum, a very large hybrid Japanese variety originated by Luther Burbank and for which Three Thousand Dollars was paid when first introduced.

5. **TETON PLUM.** For many years I have been endeavoring to collect pits and scions of pure wild plums in various parts of South Dakota, both by correspondence and personal field work. My best success in this line was in 1904 in exploring along the Missouri river near Campbell in Campbell county. The fruit was 1 3-8 inches in diameter, color good clear red; flesh of good quality. It is the best representative of the pure native plum of this state that I have found to date.

6. **CHAMPA SAND CHERRY.** A seedling of the Sioux, one of our pure sand cherry seedlings. In quality for table or culinary use, the Sioux seems to be the best out of the many thousands of sand cherry seedlings grown at this sta-

tion. But the Champa exceeds the Sioux somewhat in size and appears to be the largest sand cherry to date.

7. AMUR CRAB-APPLE. Raised from the seed of the selected Siberian crab known as *Pyrus baccata cerasifera*. There is a great demand on the market for a medium-sized crab-apple, not too large in size, free from blight, and equal in color to the Transcendent. The Amur is my first attempt in this line after raising thousands of crab-apple seedlings. This is offered as an improvement on the Transcendent crab, not in size but in color, being an intense bright red with a light bloom; a beautiful fruit.

8. OHTA RASPBERRY. Female parent, a wild red raspberry from Cavalier county in northeastern North Dakota; male parent, the Minnetonka Ironclad, a red raspberry from Minnesota. As fruited here the Ohta appears sufficiently large for commercial purposes and the bright red color makes the fruit very attractive. The berries run about sixteen to the ounce, with only fair cultivation on open exposed upland prairie. The plants are hardy without winter protection.

9. TETONKAHA ROSE. Since South Dakota is a new state the main work in horticultural plant breeding must be with fruits. But some attention is given also to developing new ornamentals, especially roses, as far as time and facilities will permit. My first attempt in this line is the Tetonkaha Rose, a seedling of the wild prairie rose from the banks of Lake Tetonkaha, about 18 miles northwest of this station, crossed with pollen of a hybrid of the Siberian *Rosa rugosa*, so that it is a combination of at least three species. The flowers are fully three inches in diameter; the bush is perfectly hardy, flowering abundantly in June; about 18 to 25 petals, deep rich pink; very fragrant; appears desirable for dwarf hedges or as ornamental shrub. The habit is more upright and the flowers less concealed by the foliage than in the pure *Rosa rugosa*.

SUMMARY.

A description of the new stone fruits distributed in earlier years is given in Bulletin 130, June, 1911. They are now being cultivated extensively by a large number of nurserymen. The numerous professional and amateur growers who have tested these new fruits have aided greatly in the early demonstration of the value of these new varieties over a wide area. Some of these new varieties have been placed on the list for trial by the South Dakota State Horticultural Society and three, the Hanska, Opata and Sapa, were placed December, 1911, on the recommended trial list of the Minnesota State Horticultural Society.

PLANT COLLECTING TOURS.

In November I visited Custer in the western Black Hills to collect plants of wild gooseberries and other wild fruits for use in fruit-breeding experiments. In December I visited western Illinois to locate a large-fruited wild crab, to obtain scions for grafting.

NEW WORK WITH ALFALFA.

Considerable attention was given to the work of introducing the new Russian and Siberian alfalfas into every county of the state as directed by the Regents of Education under appropriation from the state legislature. In November a visit was paid to the newly established Experiment Station at Oelrichs. I decided to make a trial for the first time of my new method of handling alfalfa by transplanting one year roots instead of sowing the seeds. I claim no originality for the method, except that it is combining an old Oriental method with an American machine and that this is the first time where alfalfa roots have been transplanted by machinery. One of the Bemis transplanting machines was used, the nine-inch shoe was slightly widened by a local blacksmith. The first machine planting was done on the Station farm in the Horticultural department, April 23rd; then at Redfield, Lemmon, McIntosh, Eureka, Ipswich, Bigstone, Redfield and Onida, in the

order named. At Ipswich the plants were set at the rate of 100 per minute. Plants were set with a plow, spade and hoe at Faith, Frederick, Philip, Blunt, Sansarc, Hilland, Hayes and other points. I was accompanied on the tour by Arne H. Larson, foreman, and Wm. B. Wood, field assistant and machine expert of this department. At Faith and Sansarc we had time to do most of the work ourselves, but time did not permit the use of the machine. It was a strenuous three weeks' alfalfa campaign, mainly in the northern and northwestern parts of the state where crops have been largely a failure the last two years. Many more points would have been visited but for lack of time, and the fact that the cut worms, blister beetles, grasshoppers and drouth the past year cut down the available supply of plants. Something over eighty thousand alfalfa plants were sent out to many places, including those above mentioned.

A full report of this experiment will be published in due season. Some of the advantages which occur to me at this time are:

1. The present method of sowing 20 pounds per acre means 106 seeds per square foot. Instead of that every plant should have several square feet.
2. Some of the Russian varieties when given room in good garden soil form plants with over five hundred shoots to the crown, bearing as high as three ounces of seed per plant the third year, which at 2x4 feet, means 1,021 pounds of seed per acre; or 1113 pounds at 2x3 feet 8 inches.
3. It will be easy to keep the fields free from dodder.
4. Plants dwarfed by over-crowding cannot form the long tap root necessary to endure drought. If the plants are raised on thoroughly inoculated soil, every plant will be perfectly inoculated before setting.
5. The present methods of discing are extremely injurious. Such plants quickly become black-hearted and

the germs in the soil which produce decay soon obtain entrance. This crown-rot causes the plants to die early.

6. Alfalfa is a poor fighter the first year as the main strength goes below the ground. Hence it is often choked out by weeds which make more top than root.

This is all from the standpoint of raising seed, but I believe it will work out from the forage standpoint also. My correspondence and observation lead me to believe that some method of cultivation of alfalfa will be necessary for the best results on high dry upland in the dry regions of the western states.

All of which is respectfully submitted,

N. E. HANSEN, Horticulturist.

VETERINARY DEPARTMENT

Director J. W. Wilson,
Station,

Dear Sir:

I beg leave to submit the following report of the Department of Veterinary Medicine for the year ending June 30, 1912.

The investigation of Lumpy Jaw has been continued taking up particularly the cultural features of this disease.

In addition the department has co-operated with the department of chemistry in its work on feeding horses an exclusive straw ration, paying attention to the physiological features involved.

The department is also conducting an investigation as to the reputed immunity of mule-footed hogs against cholera.

Finally we are securing the co-operation of several farmers in a field test of the value of so-called virulent blood vaccination of young pigs from immune sows.

Very respectfully,

E. L. MOORE.